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(56) Documents Cited

GB 2266005 A WO 93/05553 A1 WO 91/03085 A1

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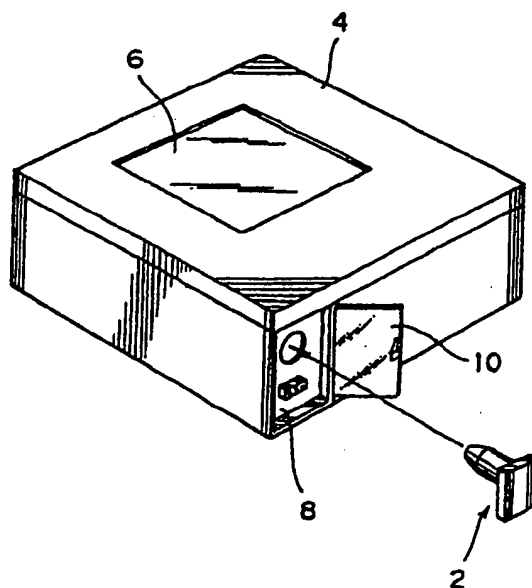
INT CL<sup>6</sup> G11B 7/10, H01S 3/02 3/025

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(54) Laser light source units

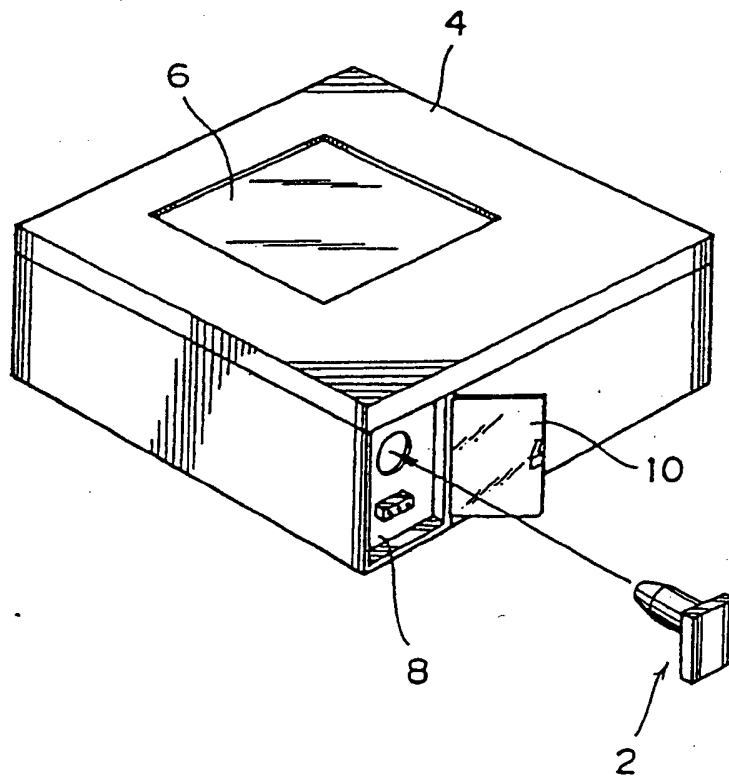
(57) A bar code scanner includes a laser light source unit 2 and an apparatus main body 4. The laser light source unit 2 has a barrel holding a lens and a unit side connector for connecting to an external circuit. The apparatus main body 4 has an insertion hole and a main body side connector. The unit side connector is connected to the main body side connector when the barrel is inserted in the insertion hole.

FIG. 1



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FIG. 1



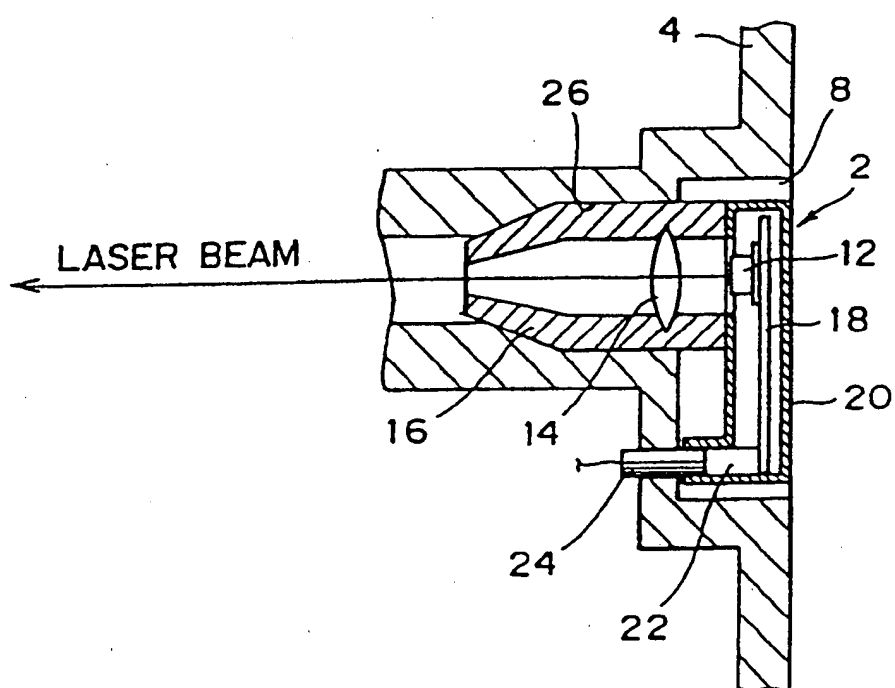


FIG. 3

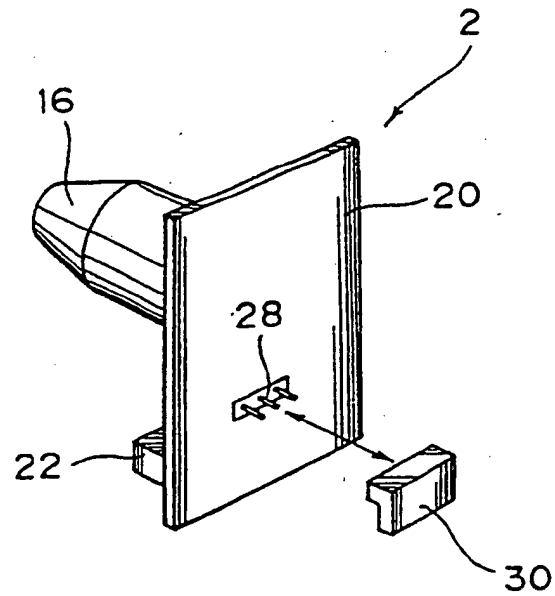


FIG. 4

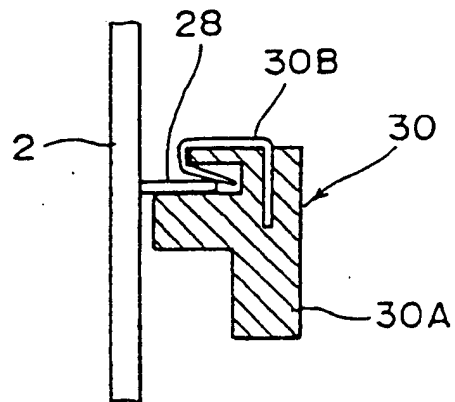


FIG. 5A

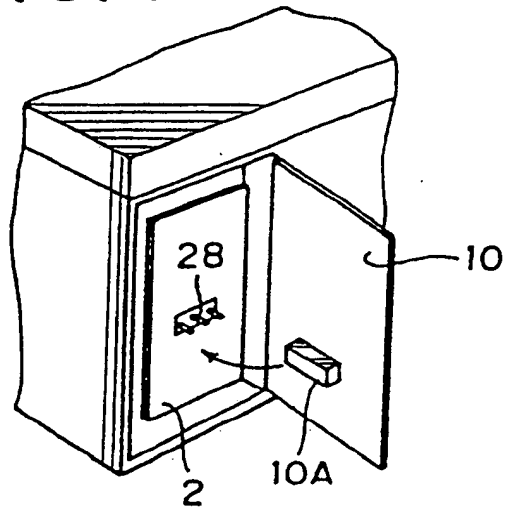


FIG. 5B

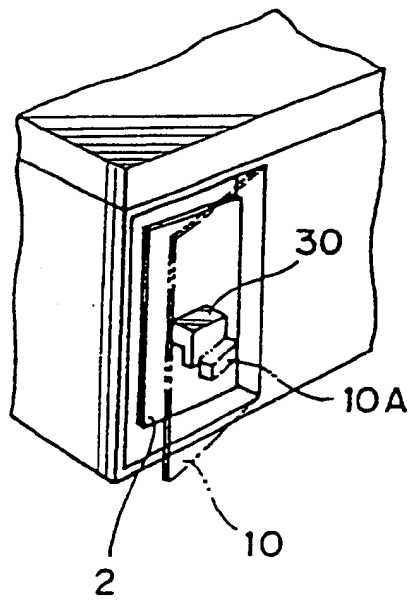


FIG. 5C

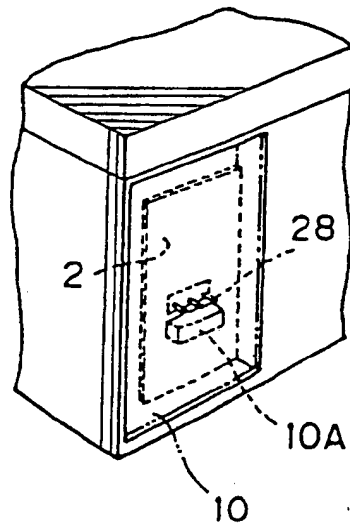


FIG. 6A

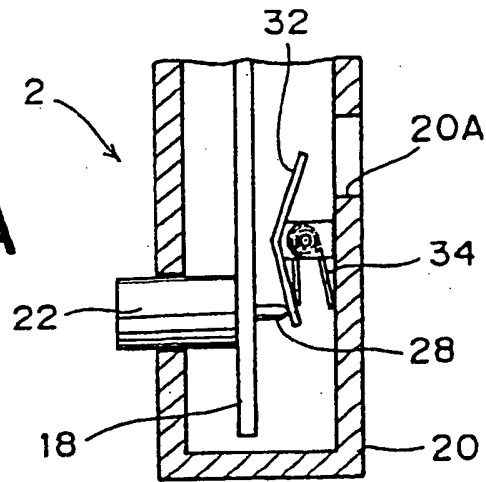


FIG. 6B

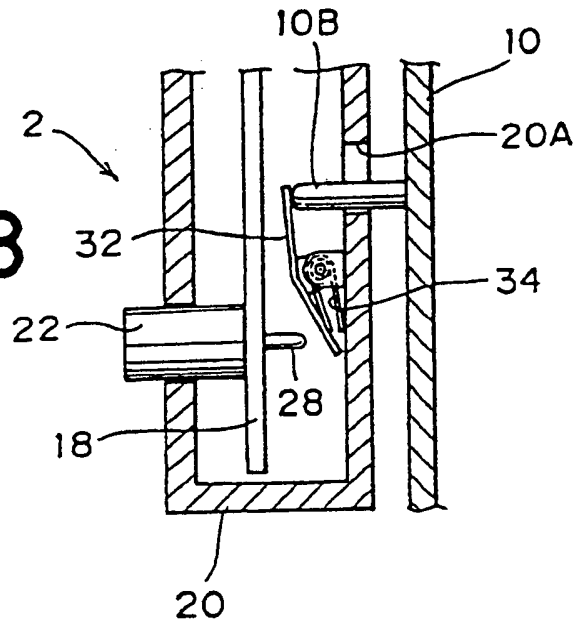
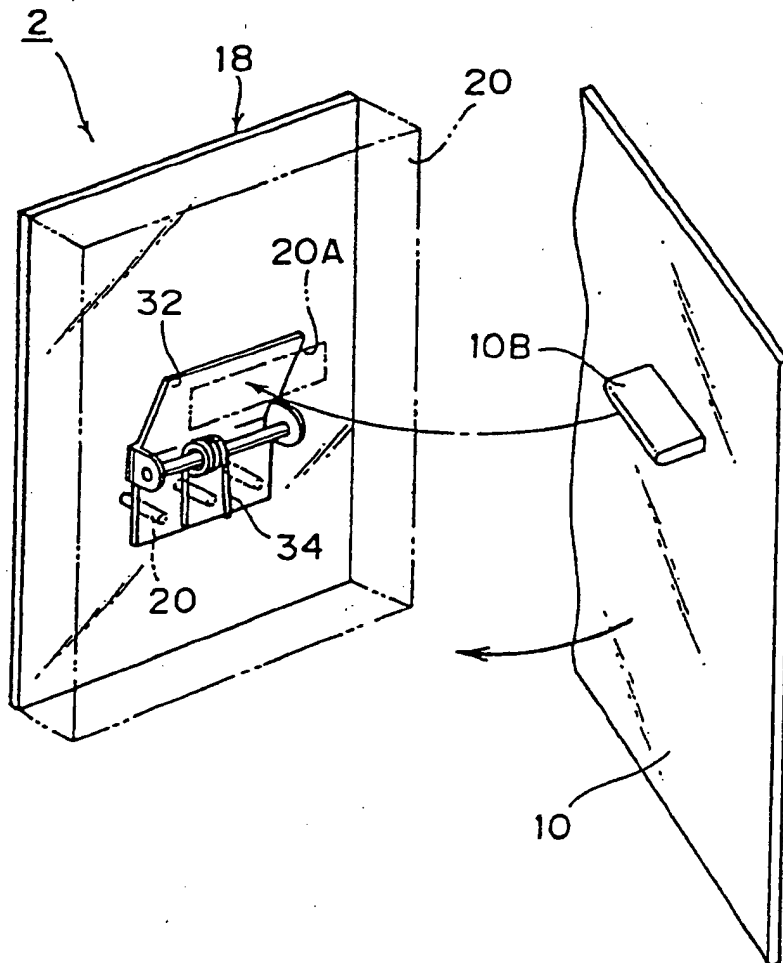


FIG. 7



LASER LIGHT SOURCE UNITS

The present invention relates to laser light source units, for example for use in an optical apparatus, such as a laser scanner, employing a semiconductor laser as a light source.

Laser scanners have been used to read bar-codes, for example in POS systems in supermarkets. As a light source of an optical apparatus of this type, a semiconductor laser (laser diode) has been used to enable the size of the apparatus to be reduced and to save power. Replacement of the semiconductor laser in a known apparatus of this type is not easy.

However, because of the short service life of a semiconductor laser relative to the normal operating life of an optical apparatus of this type, it is desirable to provide for easy replacement of the light source.

An embodiment of the present invention can take the form of an optical apparatus having a semiconductor laser as a light source, including a laser light source unit having the semiconductor laser for converting a light emitted from the semiconductor laser into a specified light beam and outputting the specified light beam; and an apparatus main body on which the laser light source unit is removably mounted. The laser light source unit further has a barrel for guiding the light beam, and a unit side connector for connecting the semiconductor laser to an external circuit. The apparatus main body has an insertion hole into which the barrel is closely inserted, and a main body side connector to which the unit side connector is connected. With this arrangement, the unit side



connector is intended to be connected to the main body side connector when the barrel is inserted in the insertion hole.

5        This optical apparatus embodying the present invention is so constructed that the laser light source unit is removably mounted onto the apparatus main body for easy replacement of the semiconductor laser. In the replacement of the semiconductor laser, the barrel of  
10 the laser light source unit is closely inserted in the insertion hole of the apparatus main body, and simultaneously the unit side connector is connected to the main body connector. The rotational position of the barrel is thus determinable, which eliminates the need  
15 for the adjustment of an optical axis.

Reference will now be made, by way of example only, to the accompanying drawings, in which:

20        Fig. 1 shows a perspective view of a bar code scanner embodying the present invention;

Fig. 2 shows an enlarged sectional view of part of the scanner of Fig. 1;

25

Fig. 3 shows a perspective view of a laser light source unit of another embodiment of the present invention;

30        Fig. 4 shows a sectional view of a short-circuiting pin cover;

Fig. 5A, 5B and 5C show, in different respective working conditions, perspective views of a possible  
35 modification of the embodiment of Fig. 3;

Fig. 6A and 6B show, in different respective working conditions, sectional views of a laser light source unit of parts of a further embodiment of the present invention; and

5

Fig. 7 shows diagrammatically a perspective view of parts of the embodiment of Fig. 6.

Fig. 1 shows a perspective view of a bar code  
10 scanner embodying the present invention. The scanner has a laser light source unit 2, containing a semiconductor laser, and an apparatus main body casing 4 on which the laser light source unit 2 is to be removably mounted. A scanning unit (not shown) scans a  
15 laser light beam through a platen glass 6 provided in an upper wall portion of the apparatus main body 4, for reading a bar code label attached on an article of commerce or the like (not shown). The laser light source unit 2 is mountable on a unit mounting portion 8  
20 of the apparatus main body 4, and is operable only when an openable cover 10 provided on the apparatus main body 4 is closed.

Fig. 2 shows a sectional view of the laser light  
25 source unit 2 mounted on the mounting portion 8 shown in Fig. 1. The laser light source unit 2 has a semiconductor laser 12, and a lens 14 for converting a light emitted from the semiconductor laser 12 into a specified light beam. The lens 14 is held in a lens  
30 barrel 16 formed in a substantially cylindrical shape which, for example, tapers-off in cross-section at its end remote from the laser 12. The semiconductor laser 12 is contained in a unit case 20 whilst being mounted on a circuit board 18. The unit case 20 is joined to  
35 the lens barrel 16 in such a manner as to hold a predetermined positional relationship between the

the laser light source unit 2. A unit side connector 22, for connecting the semiconductor laser 12 to an external circuit, is mounted on the circuit board 18. In addition, electronic parts forming a circuit for driving the semiconductor laser 12 are mounted on the circuit board 18. The unit mounting portion 8 of the apparatus main body 4 is provided with an insertion hole 26, into which the lens barrel 16 is closely fitted, and a main body side connector 24 to which the unit side connector 22 is connected.

In this embodiment, the parts are arranged such that the unit side connector 22 is connected to the main body side connector 24 when the lens barrel 16 of the laser light source unit is inserted into the insertion hole 26 of the apparatus main body. The insertion hole 26 has a shape corresponding to that of the lens barrel 16, so that the barrel 16 fits closely into the insertion hole 26. By closely inserting the barrel 16 into the insertion hole 26, the positioning of the laser beam output from the laser light source unit 2 relative to the apparatus main body 4 is determinable. Moreover, since the lens barrel 16 is usually located at the same rotational position, the direction of the laser beam is also determinable. Additionally, the semiconductor laser 12 is positioned substantially along the centre axis of the lens barrel 16, so that the laser beam can be output in the direction parallel to this center axis. Accordingly, a defective laser can readily be removed and replaced by positively mounting a new laser light source unit 2 on the mounting portion 8 of the apparatus main body 4, without any additional complicated work such as the adjustment of the optical axis. In this embodiment, the parts are arranged such that the lens barrel 16 is inserted in the insertion hole 26 when the unit side

connector 22 is connected to the main body side  
connector 24, and accordingly, there is no fear that a  
laser beam is leaked to the exterior in the state that  
the laser light source unit 2 is not mounted on the  
5 apparatus main body 4.

In the replacement of the laser light source unit,  
for preventing the breakage of an laser element due to  
electrostatic charge, it is desirable to provide short  
10 circuiting pin means on the laser light source unit,  
for example as described below.

Fig. 3 shows a perspective view of a laser light  
source unit having short-circuiting pin means. In this  
15 embodiment, a lens barrel 16 and a unit side connector  
22 are provided on the same side of the unit case 20.  
On the other side of the unit case 20, short-  
circuiting pin means 28 are provided, for enabling a  
signal line connected to the semiconductor laser to be  
20 short-circuited. Reference numeral 30 designates a  
short-circuiting pin cover which can be removably  
mounted on the short-circuiting pin means 28. The  
signal line of the semiconductor laser is short-  
circuited when the short-circuiting pin cover 30 is  
25 mounted on the short-circuiting pin means 28.

Fig. 4 shows a sectional view showing the  
construction of the short-circuiting pin cover 30. The  
short-circuiting pin cover 30 has a cover main body  
30A, formed so as to be removably mountable on the  
30 short-circuiting pin means 28, and a conductive metal  
fixture 30B having one end press-fitted into the cover  
main body 30A and an opposite end that is elastically  
deformable. When the short-circuiting pin cover 30 is  
35 mounted on the short-circuiting pin means 28, the  
conductive metal fixture 30B is elastically deformed so

as to press against the short-circuiting pin means 28 as shown in Fig. 4. This achieves both short-circuiting of the signal line of the semiconductor laser and the retention of the short-circuit pin cover 5 20. In this embodiment, when the laser light source unit is being mounted on the apparatus main body 4 shown in Fig. 1, the short-circuiting pin cover 30 remains mounted to the short-circuiting pin means 28, thereby serving to prevent damage to the semiconductor 10 laser owing to electrostatic charge.

The short-circuiting pin cover 30 must be removed after the laser light source unit is mounted on the apparatus main body 4. Fig. 5A, 5B and 5C show a 15 structure allowing an operator to easily check for the removability of the short-circuiting pin cover 30. As shown in Fig. 5A, directly under the short-circuiting pin means 28 on the inner side of the cover 10, a projection 10A is provided at the position 20 corresponding to that of a leading edge portion of the short-circuiting pin cover 30. In the case where the short-circuiting pin cover 30 remains mounted on the laser light source unit 2, as shown in Fig. 5B, the projection 10A abuts the leading edge portion of the 25 short-circuiting pin cover 30, so as to prevent the cover 10 from being closed. In contrast, in the case where the short-circuiting pin cover 30 has been removed from the laser light source unit 2, as shown in Fig. 5C, the cover 10 can be closed. Thus, by checking 30 whether or not the cover 10 can be perfectly closed, it can be judged whether or not the short-circuiting pin cover 30 has been removed.

Figs. 6A and 6B show partial sectional views of a 35 laser light source unit according to a further embodiment of the present invention; and Fig. 7 shows a

perspective view of parts shown in Figs. 6A and 6B. In this embodiment, short-circuiting of the short-circuiting pin means and the release thereof are automatically performed. In a laser light source unit 2 of this embodiment, as shown in Fig. 6A, the unit case 20 contains a rockable short-circuiting metal member 32 for short-circuiting the short-circuiting pin means 28, and a spring 34 for biasing the short-circuiting metal member 32 so that one end portion thereof is urged into contact with the short-circuiting pin means 28. An opposite end of the short-circuiting metal member 32 is located at a position corresponding to that of an opening 20A formed in the unit case 20. When the laser light source unit 2, is being mounted the first end portion of the short-circuiting metal member 32 is held in contact with the short-circuiting pin means 28 by the biasing force of the spring 34, so that the semiconductor laser is kept in the short-circuit state, thus preventing the damage to the semiconductor element due to electrostatic charge.

When the cover 10 is closed relative to the apparatus main body after the mounting of the laser light source unit, a projection 10B formed on the inner side of the cover 10 abuts the second end portion of the short-circuiting metal fixture 32 through the opening 20A of the unit case 20. Thus, as shown in Fig. 6B, the first end portion of the short-circuiting metal fixture 32 is released from the short-circuiting pin means 28, so that the semiconductor laser is placed in the operable state. In this embodiment, there is no need for the removable short-circuiting pin cover 30 of Fig. 3, so that replacement of the laser light source unit is further simplified.

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An embodiment of the present invention, as

described above, can provide an optical apparatus in which replacement of a semiconductor laser is relatively simple.

CLAIMS

1. Optical apparatus comprising a main casing  
5 and a laser light source unit operable to provide a  
light beam within the main casing, wherein the said  
laser light source unit comprises a semiconductor laser  
mounted for directing an output light beam thereof  
axially through a guide barrel of the unit, which  
10 barrel fits closely but removably in a aperture formed  
in a wall mounting portion of the said main casing so  
as to position the laser for use in the apparatus, and  
also comprises electrical connection means for  
connecting the laser light source unit to connection  
15 means carried by the said main casing.

2. For use in an apparatus as claimed in Claim  
1, the laser light source unit.

20 3. An optical apparatus comprising:  
a laser light source unit having a semiconductor laser,  
a barrel for converting a light emitted from said  
semiconductor laser into a light beam, and an unit side  
connector for connecting said semiconductor laser to an  
25 external circuit; and

an apparatus main body on which said laser light  
source unit is removably mounted, said apparatus main  
body having an insertion hole into which said barrel is  
closely inserted, and a main body side connector to  
30 which said unit side connector is connected when said  
barrel is inserted in said insertion hole.

4. An optical apparatus according to claim 3,  
wherein said barrel and said unit side connector are  
35 provided on the same side of said laser light source  
unit.



5. An optical apparatus according to claim 3 or 4, wherein said laser light source unit further has short-circuiting pin means for short-circuiting a signal line connected to said semiconductor laser.

5 6. An optical apparatus according to claim 5, wherein said laser light source unit further has a short-circuiting pin cover removably mounted on said short-circuiting pin means for short-circuiting said  
10 short-circuiting pin;

said apparatus main body further has an openable cover for covering said laser light source unit mounted on said apparatus main body; and

said cover is closed only in the state that said  
15 short-circuiting pin cover is removed.

7. An optical apparatus according to claim 5, wherein said laser light source unit further has a rockable short-circuiting metal fixture for short-circuiting  
20 said short-circuiting pin means, and a means for biasing said short-circuiting metal fixture such that the first end of said short-circuiting metal fixture is contacted with said short-circuiting pin means;

said apparatus main body further has an openable  
25 cover for covering said laser light source mounted on said apparatus main body;

said cover has a projection provided at a position corresponding to that of the second end of said short-circuiting metal fixture, and

30 said projection abuts the second end of said short-circuiting metal fixture when said cover is closed, thereby releasing the short-circuit state of said short-circuiting pin means.

35 8. A laser light source unit comprising:  
a semiconductor laser;

a barrel for converting a light emitted from said semiconductor laser into a light beam; and  
a unit side connector for connecting said semiconductor laser to an external circuit.

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9. An optical apparatus substantially as hereinbefore described with reference to Figs. 1 and 2, or with reference to Figs. 3 and 4, or with reference to Figs. 5A to 5C, or with reference to Figs. 6A, 6B and 7 of

10 the accompanying drawings.



Application No: GB 9505109.0  
Claims searched: 1 - 9

Examiner: D J Mobbs  
Date of search: 23 May 1995

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.N): H1C CG, CX

Int CI (Ed.6): G11B 7/10; H01S 3/02, 3/025

Other: ONLINE: WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2266005 A NISSAN EUROPEAN TECHNOLOGY CENTRE	8
X	WO 93/05553 A1 MASSACHUSETTS INSTITUTE OF TECHNOLOGY	8
X	WO 91/03085 A1 CRAY RESEARCH	8

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